Global Hydrology Resource Center

Data User Guide

Turbulent Air Motion Measurement System (TAMMS) IMPACTS

Introduction

The Turbulent Air Motion Measurement System (TAMMS) IMPACTS dataset consists of wind speed, wind direction, and cross wind speed measurements from the TAMMS instrument onboard the NASA P-3 aircraft during the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) field campaign. IMPACTS was a three-year sequence of winter season deployments conducted to study snowstorms over the U.S Atlantic Coast (2020-2022). The campaign aimed to (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. The files are available from January 18, 2020 through February 26, 2020 in ASCII-ict format.

Notice: The NASA P-3 aircraft did not operate each day of the campaign, therefore TAMMS data are only available for aircraft flight days.

Citation

Thornhill, Kenneth L. 2020. Turbulent Air Motion Measurement System (TAMMS) IMPACTS [indicate subset used]. Dataset available online from the NASA Global Hydrology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/IMPACTS/TAMMS/DATA101

Keywords:

NASA, GHRC, IMPACTS, TAMMS, P-3, wind speed, cross wind speed, wind direction

Campaign

The Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS), funded by NASA's Earth Venture program, is the first

comprehensive study of East Coast snowstorms in 30 years. IMPACTS will fly a complementary suite of remote sensing and in-situ instruments for three 6-week deployments (2020-2022) on NASA's ER-2 high-altitude aircraft and P-3 cloud-sampling aircraft. The first deployment began on January 17, 2020 and ended on March 1, 2020. IMPACTS samples U.S. East Coast winter storms using advanced radar, LiDAR, and microwave radiometer remote sensing instruments on the ER-2 and state-of-the-art microphysics probes and dropsonde capabilities on the P-3, augmented by ground-based radar and rawinsonde data, multiple NASA and NOAA satellites (including GPM, GOES-16, and other polar orbiting satellite systems), and computer simulations. IMPACTS addressed three specific objectives: (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. More information is available from NASA's Earth Science Project Office's IMPACTS field campaign webpage.

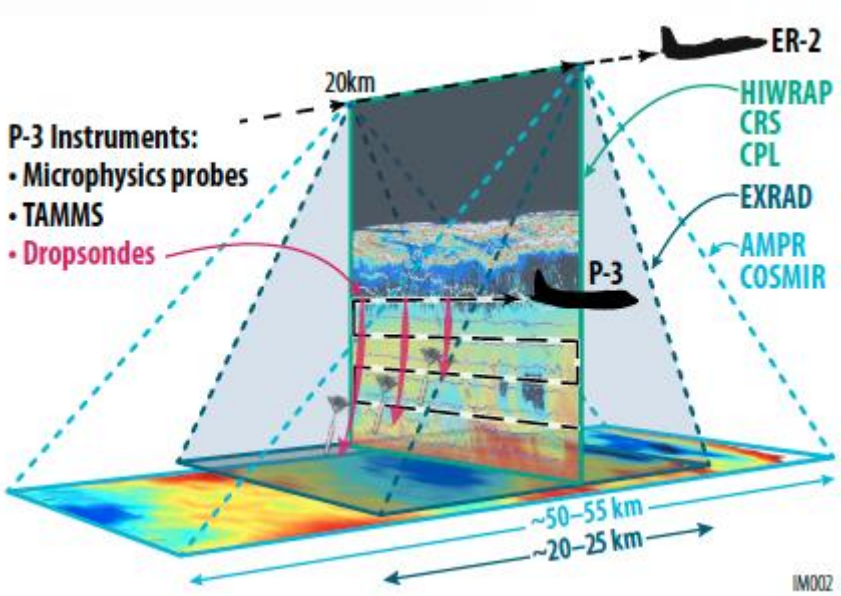

Figure 1: IMPACTS airborne instrument suite
(Image source: NASA IMPACTS ESPO)

Instrument Description

The Turbulent Air Motion Measurement System (TAMMS) instrument is composed of several subsystems including a distributed pressure ports coupled with absolute and differential pressure transducers and temperature sensors, aircraft inertial and satellite navigation systems, a central data acquisition/processing system, and water vapor instruments and other trace gas and aerosol sensors. During IMPACTS, the TAMMS instrument was onboard the NASA P-3 aircraft. More information about the TAMMS instrument is available at Turbulent Air Motion Measurement System (TAMMS), Turbulent

Air Motion Measurement System (TAMMS) | IMPACTS, Barrick et al., 1996, and Considine et al., nd.

Investigators

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Data Characteristics

The Turbulent Air Motion Measurement System (TAMMS) IMPACTS consists of cross-wind speed, wind direction, and wind speed measurements in ASCII-ict format. These data are available at a Level 1A processing level. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 1 below.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA P-3 Orion Research Aircraft
Instrument	Turbulent Air Motion Measurement System (TAMMS)
Spatial Coverage	N: 45.242, S: 33.245, E: -70.176, W: -90.414 (Northeast United States)
Spatial Resolution	5m
Temporal Coverage	January 18, 2020 - February 26, 2020
Temporal Resolution	Per flight - daily -< weekly
Sampling Frequency	<1 second
Parameter	Wind speed, wind direction, cross wind speeds
Version	1
Processing Level	1A

File Naming Convention

The Turbulent Air Motion Measurement System (TAMMS) IMPACTS data files are stored in ASCII-ict format and named with the following convention:

Data files: IMPACTS_TAMMS_P3_YYYYMMDD_R0.ict

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
ict	ASCII-ict format

Data Format and Parameters

The Turbulent Air Motion Measurement System (TAMMS) IMPACTS dataset contains wind speed, cross wind speeds, and wind direction measurement acquired by the TAMMS instrument during IMPACTS. Table 3 shows the parameters for each column within the ASCII-ict data files.

Table 3: ASCII-ict parameter descriptions

Column	Description
1	Time of acquisition, seconds after midnight in UTC
2	Latitude in degrees North
3	Longitude in degrees East
4	Platform altitude in feet
5	Aircraft pitch in degrees
6	Aircraft roll in degrees
7	Static temperature in degrees Celsius
8	Meteorological wind speed in m/s
9	Wind direction in degrees
10	Horizontal wind speed in m/s
11	Vertical wind speed in m/s
12	Cross wind speed in m/s

Algorithm

The airplane altitude angles obtained from the Inertial Navigation System (INS) were electrically fed through a 16-bit synchro-to-digital converter to yield an angular resolution of 0.005 degrees. The vertical velocity of the airplane was derived by integrating the vertical acceleration output of the INS and bounding it by the third-order barometric-inertial loop algorithm as suggested by Lenschow, 1986. More information can be found in Lenschow, 1986 and Barrick et al., 1996.

Quality Assessment

The long-term accuracy of the horizontal velocities are dictated by the INS drift rate. More information can be found in Barrick et al., 1996.

Software

No special software is required to view these ASCII-ict data files.

Known Issues or Missing Data

The NASA P-3 aircraft did not operate each day of the campaign, therefore TAMMS data are only available for aircraft flight days.

References

Barrick, John D. W., John A. Ritter, Catherine E. Watson, Mark W. Wynkoop, et al. (1996). Calibration of NASA Turbulent Air Motion Measurement System, NASA Technical Paper 3610.https://www.researchgate.net/profile/John_Barrick/publication/2671384_Calibration_of_NASA_Turbulent_Air_Motion_Measurement_System/links/02e7e51f6c59766202000000/Calibration-of-NASA-Turbulent-Air-Motion-Measurement-System.pdf

Considine, Geoffrey, Bruce Anderson, and John Barrick. The P-3B Turbulent Air Motion Measurement System (TAMMS). https://www-gte.larc.nasa.gov/pem/considine.htm

Lenschow, Donald H. (1986). Probing the Atmospheric Boundary Layer. American Meteorol. Soc.

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NASA ESPO (2020). IMPACTS. https://espo.nasa.gov/impacts/content/IMPACTS

NASA ESPO (2020). Turbulent Air Motion Measurement System (TAMMS). https://espo.nasa.gov/impacts/instrument/TAMMS

Related Data

All other datasets collected as part of the IMPACTS campaign are considered related and can be located by searching the term “IMPACTS'' in the GHRC HyDRO2.0 search tool.

Contact Information

To order these data or for further information, please contact:

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